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ABSTRACT

This study of the feasibility of using existing videocassettes for interactive video included field tests with Open University summer school students. The aims of the study were to discover whether video material originally made for broadcast could be used in an interactive program which involves breaking up the intended flow of the program; whether students would find it desirable to alternate between video presentation and computer-based exercises as a way of learning or revising material; and how much choice and how much advice students would need to be able to make the best use of the medium. Field trials showed that: (1) it was not feasible to avoid breaking up the video program by allowing students to interrupt it (modifications were made to the program so that it fades to black at the end of each sequence); (2) students do not make use of the opportunity to alternate between the two media, but sometimes prefer to continue using just one medium, depending upon their current strategy; and (3) students appreciate having maximum choice over both content sequence and instructional strategy; they also prefer to be forced to make a choice, rather than to interrupt the video as they wish, and to have advice on an appropriate content sequence should they wish to make use of it. (EW)

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Interactive Video-Cassette Feasibility Study

Formative Evaluation Report on 'Signals'

D.M. Laurillard

AVMRG

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1. Introduction

Interactive video can refer to a variety of different ways of controlling the presentation of video teaching material. The most common usage refers to the computer control, through an interface board, of a videodisc player, or a video-cassette player. The existence of this form of interfacing provides a new teaching media combination of computer-assisted learning (CAL) and video.

The present study was set up to investigate the feasibility of using existing video cassette material for interactive video. Using an Open University television programme, a series of CAL packages were written to provide exercises and tests on the material being taught in the programme. The aims of the study were to discover:

(i) Whether the video material, originally made for broadcast, could be used successfully in interactive form, which necessarily involves breaking up the intended flow of the programme.

(ii) Whether students would find it desirable to alternate between video presentation and computer-based exercises, as a way of learning or revising the material.

(iii) How much choice, and how much advice they would require to be able to make the best use of the medium.

The report describes the materials developed, together with the results of a series of field trials at an Open University summer school.

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2. The Teaching Materials

The 'signals' unit on the T101, Technology foundation course was chosen for the study, because the teaching material was self-contained, including a half-hour TV programme and a 20 page study text with self-assessment questions (SAQs).

The TV programme was highly structured, and didactic in form, and thus lent itself well to being restructured as a series of self-contained instructional sequences.

For each concept covered by the programme, and for each additional concept covered by the unit, a CAL programme was written to provide practice exercises, with tutorial guidance where necessary, and tests of the student's understanding of that concept. The form of these was based on the form of SAQ's in the text, with the embellishments that interactive computer graphics allowed. The teaching provided by the CAL programms did not go beyond that already contained in the unit.

The two media were combined in a Master programme which had a similar structure to that in Figure 1. One of the project aims was to find out how much guidance the student needed, and how much choice they wanted. The structure of the interaction between the two media was designed, therefore to give maximum choice to the student, over both instructional sequence (by providing indexes to both the video sequences and the CAL programs), and instructional strategy (by allowing the student to choose when they had presentation from video, when they had exercises from CAL, and how many exercises they had). By providing maximum choice, it would be possible to discover how far they were able to make use of this, whether individual student strategies varied, and where the format would break down and students feel the need for guidance. Details of the equipment and interfacing software are included as Appendix 1.

3. Field Trials

Field trials on the material were carried out at an Open University summer school, with T101 students who had completed the 'signals' unit 5 months earlier. The equipment was set up in an annexe to a microprocessor

laboratory, where students were carrying out a one-day self-paced practical exercise. This set-up made it possible for students to be recruited at intervals throughout the day, to try out the interactive video teaching package. Each trial session lasted 30-60 minutes.

Trials were run in the afternoon of each day, which allowed one evening and one morning for adjustments to be made to the software before the next trial was run. The four trial runs consisted of 8 students (including 3 pairs), 6 students (including 2 pairs), 3 students (including 1 pair) and 5 students.

Each trial began with a short computer-based pre-test, covering the main concepts in the unit. Students were told only whether their answers were right or wrong and were given a final score at the end. The students were then started on the teaching material, and allowed to work through it as they wished. When they had finished, they were asked "what did you think of this method as a way of learning this kind of material?" All student inputs and comments were recorded for later analysis.

4. Results of the Field Trials

4.1 Test results

One test question proved highly problematic, because it asked for open-ended descriptions of each stage of the analogue - digital - analogue conversion sequence. Students found a variety of ways of describing this, many of them correct, but analysed incorrectly by the answer-matching routine in the program. Ignoring these answers, test results out of a total of 9 questions gave an average score of 4.7, ranging between 0 and 9.

4.2 Cal exercises

A number of findings were specific to the CAL part of the material. Most of these mirrored the findings of previous evaluation studies of CAL.

4.21 It is important to insert 'please wait...' instructions whenever the computer is likely to take a long time to respond, e.g. when it is loading from diskette. The buffer on the Apple stores up to one character, and if students press Return a second

time, this will be accepted as the response to the next question.

4.22 The exercise on the procedure of converting an analogue, used a keyboard-based answer-making analysis of the students responses to the question: 'What is the next step'? It is difficult to capture all possible correct responses to this, as students can respond at different levels of description according to the sophistication of their understanding. The solution appeared to be to list a series of descriptions of the various steps, in random order, and ask the student to order them correctly. This is a much less demanding exercise, and therefore less beneficial, but it would require more storage space than is available on the Apple II to provide an adequate answer-matching routine for a problem of this complexity.

4.23 The exercise on the frequency spectrum, asked students to evaluate whether the plot for a particular waveform was correctly placed. Sometimes the amplitude was wrong, sometimes frequency was wrong, sometimes both were correct. After the student's response, the computer produced text stating 'correct' or 'incorrect', erased the incorrect plot, drew the correct one and stated 'it should be as shown'. The field trials showed that students who were not paying attention to, say, the value of the amplitude, could not tell that this had changed. It was important, therefore to focus their attention on this. The second version therefore suggested, in response to an incorrect input: 'NO - look at the frequency/amplitude. Press return'. Then the incorrect plot was erased and the program continued as before. This amendment appeared to solve the problem for the remaining students.

4.24 In exercises where students had difficulty in answering correctly, the programs were designed to offer help with the step-by-step calculation procedures. It was important for some students not to miss out any steps. For example, the program on calculating the frequency of a waveform included the step "the period is n ms, frequency is the reciprocal of the period in secs, so what is the frequency?". For some students this step was too difficult, including as it did the conversion of period to seconds, and taking a reciprocal - some did not know what a reciprocal was.

The second version amended this step to "1 cycle is n ms long, so the period is n ms. Frequency is 1 divided by the period in seconds. The period is n ms or n/1000 seconds. So what is the frequency?" After going through this expanded guidance several times, the students having difficulty were eventually able to do the calculation without help.

4.25 Most of the students commented that they liked being able to choose how many exercises they did for each program. And indeed this was essential, because students who had no difficulty answering the first exercise would usually abandon that program immediately, others who were less certain would repeat 3 or 4 exercises to make sure they understood it, while those who had real difficulty needed as many as 10 or 12 exercises before they felt confident with it.

4.3 The video sequences

Most of the students in these field trials had already been exposed to the subject matter, and had seen the TV programme when broadcast. The trial therefore took the form of a revision section for most of them. This meant that they felt they did not need to use the video very much, only when the material was unfamiliar. Several students commented that this video presentation was good, clear and easy to follow, and they expect to use it a lot if they were learning the material for the first time.

4.4 The combination of CAL and video

The main focus of the study was the students' reaction to the combination of the two media, the interaction between them, and the degree of learner control available. A number of interesting findings emerged.

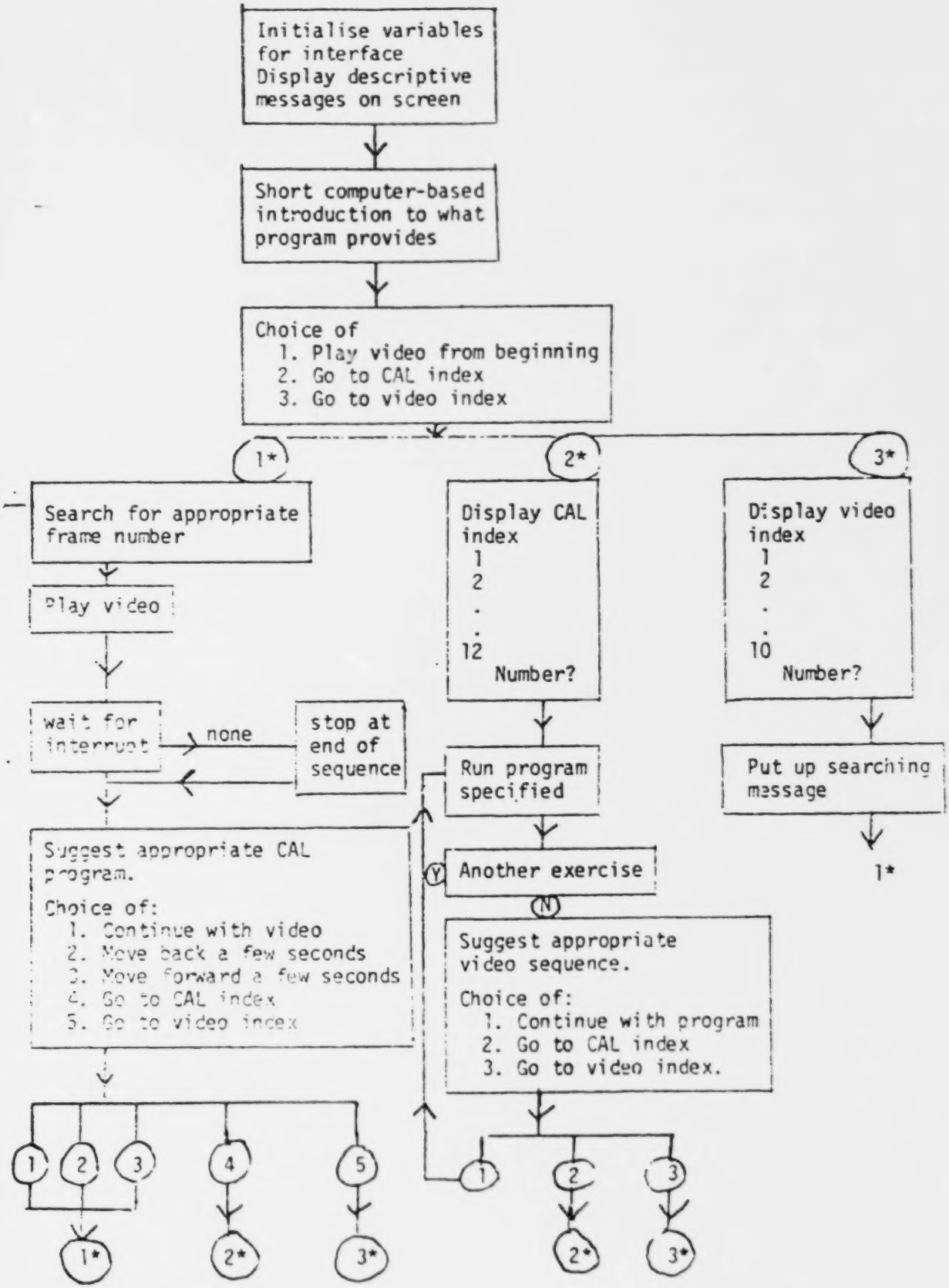
4.41 It was useful to put up a frame describing what was happening as the VCR machine searched for the sequence requested. This reassured the students that they were not expected to do anything but wait. They were surprisingly tolerant of waiting times up to 20 seconds, and none complained of this in the interview. Whether this degree of tolerance would survive repeated usage of the medium needs to be tested.

4.42 One of the important questions to be answered by the field study was whether students would indeed alternate between the two media as intended. No advice was offered as to what to do when, and the decision to stop the video was left to the student - when a particular sequence was chosen, the video was played from the start of that sequence to the end of the tape, if not interrupted. The effect of this was that for the first 5 sets of students they tended either to keep doing CAL programs, or, once they started on a video sequence, would let it run without interruption. This is inevitable given that (a) the CAL programs are highly rewarding as they give instant feedback on student action, and (b) the video is designed to hold the attention and to flow continuously from one point to the next. The students in this first trial run commented that they would like the video to stop automatically at the end of a scene, and would like advice as to which CAL program was associated with which video sequence. These modifications were made for the remaining trials (see Figure 1).

4.43 The first effect of this modification was to reduce the number of occasions when a student ignored the opportunity to switch media from 50% to 14%. Thus, in the remaining trials, students alternated between the two media far more, but still reserved the option occasionally to stay with the same medium. It is important, therefore, to give them this degree of choice.

4.44 The second effect resulted from advice given at the end of each CAL program/video sequence, stating which video program/CAL sequence was associated with it. Most students ignored the advice: on 28 occasions the advice was ignored, on 8 it was accepted. However, two of the students used the session explicitly in order to learn the material, having scored respectively 1 and 0 on the test and adopted the strategy of working sequentially through all the CAL programs, scarcely using the video. If these are ignored, the ratio of ignoring to accepting advice reduces to 2:1 (14 occasions versus 7 occasions). It is clear, therefore, that although the advice is certainly useful to some students, it should remain advisory. If the students were automatically routed from section to section, as is the case with most interactive video currently available,

Figure 1. Structure of Interactive Video Master Program



the majority of students here would have found this intrusive on their preferred learning strategy.

4.45 One further complication was indicated by one student who followed the advice so exactly that he was inclined to go round in circles i.e. at the end of video sequence 6, he was told that CAL program 7 was associated with it, so he chose that; at the end of this he was told that video sequence 6 was associated with it, so chose the same video sequence again, mistakenly. For students who wish to be guided at each stage, therefore, it is clear that the advice must define a sequential route through the material, and this modification has now been added (see Figure 1).

4.46 In the interviews, most students commented that they liked having the choice of which medium to use when, and which content sequence to go through. This was borne out by their sequences of choices, which were fairly random, except for the two students who set out to learn the material they had forgotten by working through sequentially. Of the other students, some would try the exercises first and then look at the associated video if they felt they had not done well; some would look at the video before trying the associated exercises; some began with content they found easy; some went straight to the content they had difficulty with on the test. It is clear that the student's choice of learning strategy will vary according to whether they are learning from scratch, or revising, and this will affect both the amount of alternation between the media, and the sequence of content choices. This means that it is important that the interaction be designed to cater for all these possible choices, and not impose unnecessary control over either the sequence or the strategy of instruction.

4.47 In the second round of trials, only 2 of the 10 sets of students made use of the interrupt facility on the video, in order to move back a few seconds and repeat a section, whether this is an important facility would have to be judged on the basis of more extensive trials.

5. Discussion

The students were surprisingly enthusiastic about the medium of interactive video cassettes, considering its obvious disadvantages of a jarring interruption at the end of each video sequence, and the time-consuming search for the beginning of a sequence. It may be that technology students are unusually machine tolerant, and in any case, they correctly regarded this as an experiment and were therefore inclined to be tolerant of its inadequacies. Their responses to the idea of learning in this way were sufficiently encouraging however, that it is worthwhile to continue the experiment.

The next stage must be a more extensive field trial with students who are studying the material for the first time, at the appropriate stage in their course. With two work stations available, it will be possible to place these with aporoximately 10 students, for their home use for 2-3 days each, within the time that students will wish to study the material. This will enable the study to investigate students' experiences of using interactive video, compared with using TV, audio-vision and text.

In terms of the original aims of the study, the conclusions are:

(i) That it is not feasible to avoid breaking up the video programme by allowing the student to interrupt it. Each sequence must stop at the end, giving the student the option to continue or go to either index. In order to relieve the jarring quality of this interruption, the original video programme has to be doctored to fade to black (under the audio, if necessary) at the end of each sequence. This format will be tested at the next stage.

(ii) Students do make use of the opportunity to alternate between the two media, but sometimes prefer to continue using just one medium, depending upon their current stratgey.

(iii) Students appreciate having the maximum amount of choice over both content sequence and instructional strategy (i.e. whether they need presentation or exercise, and how much exercise). They also prefer to be forced to make a choice (rather than interrupt the video as they wish), and prefer to have advice on an appropriate content sequence should they wish to make use of it.

Acknowledgements

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